



# DEVELOPMENT OF LABORATORY WORKSHEET BASED ON PROBLEM BASED LEARNING TO IMPROVE STUDENT LEARNING OUTCOMES

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## ABSTRACT

A factor that cause the students outcomes of grade XI low is using only one school chemistry book. This research has aim to develop Problem Based Learning Laboratory Worksheet toward student results on buffer solution. The subjects of this study were students grade XI senior high school. The method of this research is research and development (R&D), 3D that are define, design and develop. Data in this research were obtained using the method of observation, interview, questionnaires, and test. The data are feasibility of problem based learning laboratory worksheet, the students learning outcomes, and responses from students also teacher. Data analysis using quantitative descriptive method. Quantitatively, the data were analyzed by calculating the mean score and determine the criteria at intervals of a certain class. Based on the result of the research of analyzing the feasibility of laboratory worksheet is very well criteria with presentation is 91,9%. Laboratory worksheet included in the category of effective because classical completeness is 100% and N-gain is 0,78 (high). Worksheet get a good response from user. So, it can be concluded that laboratory worksheet based on problem based learning is feasible, get positive response from user and can improve student learning outcomes, so it can be used in chemistry learning process.

**KEYWORDS:** Laboratory Worksheet, Learning outcomes, Problem Based Learning.

## INTRODUCTION:

Approach and model of learning in the curriculum wants students to be able to learn independently and the learning process is no longer the teacher center but the student center and it is called scientific approach. One of model in scientific approach is problem based learning (PBL) (Sariono, 2013).<sup>8</sup> Problem-based learning is a learning approach that uses real-world problems as a context for students to think critically and problem-solving skills, and to acquire deep knowledge and concepts of subject matter.

Learning process with well-designed problem based learning model will make the learning process more meaningful for the students. Learning process with problem based learning model also improves students' ability in analyzing and solving problems (Hakkarainen, 2011).<sup>4</sup> Learning with problem-based learning model can increase the concentration of students who have difficulty in developing value and strong knowledge base (Ge et al, 2011).<sup>5</sup> Problem based learning model is a learning approach where the problem is the beginning of the learning process. Problems in PBL learning are based on student background, student's expectation and interest. So that in the learning process students are more motivated to learn harder than to learn with traditional methods (Graaff & Kolmos, 2003).<sup>3</sup>

The process of studying natural science requires guidance. However, current school manuals are still theoretical verification and book recipe (Arifin, 1995).<sup>1</sup> The results of the analysis on several chemistry books indicate that there is a part of the activities of practicum chemistry on the books, but the presentation of practicum activities in the form of verification theory test.

Laboratory worksheet is a supporting book or guidance when doing lab work in the laboratory. The laboratory worksheet contain the materials and procedures of practicing proper activities. The purpose of giving laboratory worksheet is so that students not only learn theoretically in class, listening to teacher explanations but expected students more active in learning activities to find or manage their own acquisition of learning (knowledge and skills) and it is expected from the laboratory worksheet student can obtain knowledge, understanding, expertise and attitude of scientific truth (Suriyanto, 2011).<sup>12</sup> Students can perform and develop process skills especially with the provision of problems in the laboratory worksheet and students must be able to find ways or methods to solve the problem with an experimental proof both individually and in groups (Trisnawati, 2011).<sup>13</sup> The formulation of the problems in this study there are three, namely: 1) how the feasibility of laboratory worksheet?, 2) how the effectiveness of the laboratory worksheet against student learning outcomes? and 3) how the response of teachers and students to the laboratory worksheet.

## MATERIALS AND METHODS:

The research was conducted in one of senior high school on the topic of buffer solution. This research uses research and development procedures. This development study refers to the development design of Sugiyono (2009) that are define, design and develop.<sup>11</sup> The sample are 25 students of grade XI. The appropriateness of the practicum is assessed by 2 experts using a validation sheet. The method used in this research is test and questionnaire. Analysis data of feasibility, learning outcomes and questionnaire responses of students and teachers were

analyzed descriptively quantitative. Data of the research results are analyzed by calculating the average of results and determining the criteria at a certain class interval.

## RESULTS AND DISCUSSION:

The results of the study "Development of laboratory worksheet based on problem based learning" include 1) product feasibility, 2) student learning outcomes and 3) responses to the laboratory worksheet. The laboratory worksheet design got validation, criticism, and suggestion by 2 experts that are chemistry lecturer and chemistry teacher. Experts assessed 4 aspects of content, presentation, grammar and language. The results of the laboratory worksheet feasibility can be seen in Table 1.

**Table 1: Results of Feasibility Test of Laboratory Worksheet**

Expert Code	Content (%)	Presentation (%)	Grammar (%)	Graphic (%)
VAL-01	95,45	98,21	86,36	86,11
VAL-02	93,18	98,21	86,36	91,67
Average	94,31	98,21	86,36	88,89
Average Score				91,95

Based on Table 1. It is known that the average of expert validation results is 91.95% with very reasonable criteria. This means that the validator states that the laboratory worksheet are appropriate for use in the learning process to improve student learning outcomes. The expert also gives some suggestions as in Table 2.

**Table 2: Expert Suggestion to Laboratory Worksheet**

Suggestion	Follow-up
The design and illustration of the cover have not yet shown the laboratory worksheet	Changing the design and illustration of the cover laboratory worksheet
Lack of illustrations	Added illustration
Only 2 practicum activities, it should add more activities	Adding practicum activities at the worksheet into 4 practicum activities
The problems that exist in the worksheet have not been contextual	Changing the problem in laboratory worksheet
The PBL steps have not been seen in the precise activity	Adding PBL steps in practicum activities consisting of problem orientation, information gathering, group investigation, communicating, and evaluation and reflection

Based on Table 2. It is known there are some suggestions from experts. The suggestion becomes an input for the improvement of laboratory worksheet so the laboratory worksheet is better.

The effectiveness of laboratory worksheet in terms of cognitive learning outcomes shown that students' classical completeness is 85%. Data of pretest and post-test result is used to know the improvement of student learning result of cognitive aspect. Analysis of students' cognitive learning outcomes can be seen in Table 3.

**Table 3: Analysis of Learning Outcomes of Cognitive Aspects**

Student Learning Outcomes	Score
Highest point	3,25
Lowest point	2,78
Average point	3,07
Students who complete learning	25
Unfinished students	0
Classical completeness (%)	100

Based on Table 3, it is known that learning using a laboratory worksheet shows positive results. This can be seen from all students thoroughly with students' learning completeness classically is 100%. Obtain the average point student is 3.07 with good category. Students' learning outcomes of cognitive, affective, and psychomotor aspects of learning LPS-assisted PBL obtained good results (Rosidah et al., 2014)<sup>7</sup>.

Student learning outcomes were also analyzed using a gain index. Based on the N-gain, 2 students are medium category with value more than 0.62 and 23 students are high category high with value of more than 0.70. The result of student improvement was 0.78 with high category. Learning outcomes on the knowledge aspect showed positive results based on the classical completeness obtained by 100%, it means that all students achieve mastery learning. This is in line with Mulyasa (2007)<sup>8</sup> which states that learning is considered successful in a classical manner, if student learning outcomes reach 85%.

The success of this classical mastery achievement is influenced by the success of the students in learning the topic of buffer solution. Students do the laboratory activity after that students look for information about buffer solution so that students easily understand the topic of buffer solution because students learn independently so that more meaningful in understanding the material being taught. Laboratory activity is a way to encourage students to learn and understand a problem as well as construct new knowledge by doing scientific practice. Laboratory activities are also one way for students to build their own understanding of scientific concepts, scientific abilities and perceptions of science (Sezgin et al, 2013)<sup>9</sup>.

Positive learning results shows that problem based learning process provides good learning outcomes. This is supported by the results of Sezgin et al's (2013) study, which says that the classroom learning process using the problem based learning model gets the best results compared to the learning class with the strategy of the traditional learning model in the physics class.<sup>10</sup> Roberto (2013) also said that problem based learning process makes learning process more fun, more dynamic classes and improves learning challenges for students so as to make student learning outcomes better according to the statement.

Student and teacher response data on large-scale trials show positive results. The result of the percentage of student responses showed a positive response from the students of 88% with very good criteria. While the percentage of teacher responses also showed a positive response of 91% with very good criteria. This states that diktat practicum developed to provide convenience to teachers in delivering material to students.

## CONCLUSIONS:

Based on the results, it can be concluded that the laboratory worksheet has an average score of >91.95%, so categorized very feasible. The laboratory worksheet is effective to improving student learning outcomes. Learning outcomes of cognitive reaches 100% classical completeness with a gain index of 0.78 with high criteria. In addition, based on teacher and student responses, the use laboratory worksheet in learning of buffer solution showed positive results. Student response shows an average percentage of 88% with very good criteria.

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